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Clinical specialty training in UK undergraduate medical schools: a retrospective observational study

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Clinical specialty training in UK undergraduate medical schools: a retrospective observational study

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Contributor Statement:
HJV, AWE and AJM conceived of the study and its design. ECA and AWE completed initial data collection and HJV, AWE and AJM completed data extraction. HJV completed the majority of the statistical analysis and CB assisted. HJV and AWE wrote the majority of the first draft, and the other authors contributed to refine it. All authors then contributed to refine and review the final draft and gave their consent for submission.

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Hrisheekesh J Vaidya serves as the guarantor for this piece. The guarantor affirms that this manuscript is an honest, accurate and transparent account of the study being reported; that no important aspects of the study have been omitted; and that there were no discrepancies from the study as planned.

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Competing interests:

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Data sharing:
Raw data used to complete this study is available from the authors on request.

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ABSTRACT

Objectives

To determine if increased exposure to clinical specialties at Medical School is associated with increased interest in pursuing that specialty as a career after foundation training.

Design

A retrospective observational study

Setting

28 UK undergraduate medical schools. Medical schools were asked how much time undergraduate students spend in each of the clinical specialties. We excluded schools that were solely Graduate Entry, those that were recently established, and those for which we could classify a number of weeks less than one interquartile range below the lower quartile.

Main outcome measures

Time spent on clinical placement from UK undergraduate medical schools, and the training destinations of graduates from each school. A univariate general linear model was used to analyse the relationship between the number of weeks spent in a specialty at medical school and the number of applicants from that medical school applying to each of the CT1/ST1 specialties

Results

Students spend a median of 84.5 weeks in clinical training. This includes a median of 28 weeks on medical firms, 14.8 weeks in surgical firms, and 8 weeks in general practice. The percentage of time spent on different specialties in medical school did not correlate with the

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number of job posts available at CT1/ST1 level (R=0.43, p=0.16), nor with the number of applications to that specialty nationwide (R=0.49, p=0.11). We also found that the number of weeks spent in a specialty at medical school did not predict the percentage of graduates of that school training in that specialty at CT1/ST1 level (β=0.083, p=0.077).

Conclusions

We found that there was no correlation between successful applications to specialty training programmes and the length of time spent in those specialties at medical school. This raises questions about whether curriculum adjustments focusing solely on length of time in certain settings will help tackle the recruitment crises going forward.

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<u>Strengths and limitations of this study</u>

- This is the first study to consider the actual career decisions made by an entire cohort of doctors, from all UK undergraduate medical schools and across all specialties, and correspond these with the clinical curricula they would have been exposed to in their individual medical school.
- This is also the first study to consider the average time spent on each subject across UK undergraduate medical education, and assess whether this correlates with the number of jobs at CT1/ST1 level.
- We only looked at one year, 2016, for our data on CT1/ST1 jobs. Doctors entering CT1/ST1 at this time would have completed medical school in 2014. However, our study collected data on medical school curricula during 2016/17.
- We do not have data on which specialty doctors applied to for their CT1/ST1 jobs, only the specialty they ultimately obtained a job in.

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- We could not assess the impact of the student-selected components or assistantships offered by every medical school. The weeks spent in these placements may disproportionately influence career choice.

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INTRODUCTION

The NHS is facing unprecedented recruitment pressures, particularly in areas such as General Practice (GP). The Department of Health has set a target in 2015 to recruit an extra 5000 GPs by 2020, in part by aiming to double to growth rate in GP numbers [1]. However, there are concerns this target may not be met [2]. Other areas are also facing pressures, notably psychiatry and emergency medicine [3].

It has been suggested that exposure to medical specialties at medical school influences career choice [4–9]. Based on this, it is argued that medical school curricula should be more appropriately tailored to the recruitment demands of the 21st century. Recent research appears to have identified an association between the quantity of clinical GP teaching at medical school and entry into general practice training; Alberti (2017) found that there was a statistically significant association between the quantity of general practice training and the percentage of graduates entering general practice training pathway after the Foundation Year 2 (F2) year [4]. However other specialties have not, to our knowledge, been examined in the same way. The majority of other evidence supporting the suggestion that exposure determines later choices comes from surveys conducted during medical school, where students are asked either about their interest in pursuing a specialty after having been exposed to that specialty on placement [5,8,9], or about their perceptions or attitude to that specialty as a whole [10]. However, preferences at this point may be transient [11] and so not actually have an impact on future career decisions. Furthermore in historical analyses it appears that progressive increases in exposure to General Practice over the last 30 years has not correlated with an increase in the proportion of UK graduates entering general practice [6,12].

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In the UK, the General Medical Council supports and regulates medical education, and is responsible for quality assurance. Medical schools are free to design their own curricula, and guidance prior to 2016 [13] stated that these curricula must be structured to include a range of specialties, *"including medicine, obstetrics and gynaecology, paediatrics, surgery, psychiatry and general practice".* However, since January 2016, when *Tomorrow's Doctors* [13] was superseded by *Promoting excellence* [14], the guidance on the clinical specialties that students must be exposed to has become more generalised - now simply stating that "*medical school curricula must give medical students experience in a range of specialties, in different settings, with the diversity of patient groups that they would see when working as a doctor (R5.3b)."*

We therefore wanted to understand the current exposure to different medical specialties at UK undergraduate medical schools and examine whether the percentage of time spent in the different specialties correlated with the number of posts available at CT1/ST1. We also wanted to examine the relationship between exposure to clinical specialties at medical school and the percentage of each school's graduates ultimately being appointed to each postgraduate CT1/ST1 specialty training programme.

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METHODS

Data collection

Freedom of Information (FOI) requests were sent to all 30 UK undergraduate medical schools asking how much time students spend on placement in each of the medical specialties as part of their clinical education. We excluded schools that were solely Graduate Entry due to differences in the structure of their curricula, and we also excluded recently-established schools who had not yet produced medical graduates. Where data were missing, or medical schools did not respond, we accessed university websites (March 2017) to obtain as complete a dataset as possible.

An additional FOI request was sent to Health Education England to determine the medical school attended by each doctor directly entering a specialty training programme after foundation training in 2016.

Finally, we accessed publicly available data on 2016 specialty training posts and applications from the Health Education England website.

Patient and Public Involvement

There was no formal involvement of patients or the public in this study.

Data cleaning

Data were collated into a spreadsheet and analysed with Microsoft Excel 2016, SPSS Version 24.0, and SciPy (Scipy 0.19.1, python 3.6.0).

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Any medical schools for which we could classify a number of weeks less than one interquartile range below the lower quartile (Q1 - IQR) were excluded due to insufficient data. The names and scope of individual curricula components differed between medical schools. We therefore standardised the curricula based on the training programmes offered by Health Education England (HEE) so that appropriate curriculum components were linked with their relevant CT1/ST1 specialty (Appendix Table A1). As very few medical schools offered cardiothoracic surgery, maxillofacial surgery, or neurosurgery specifically, and all three are available at both ST1 and ST3 level, we combined these into Surgery.

Special attention is drawn to the components of the Acute Care Common Stem programme (ACCS): Emergency Medicine, Anaesthetics, Critical Care, Acute Medicine. The latter two of these were combined into Medicine for the first part of the analysis, as this is how Health Education England group the subjects. However, for the final part of our analysis, specialty information from the survey carried out by UKFPO was provided with data grouped as "Acute Care Common Stem (ACCS)" and "Anaesthetics". We collated both into a single "ACCS" specialty, and compared this with a composite category from our curricula data with all four ACCS components (Figure 1).

Statistical models

A Shapiro Wilk test for normality was performed using SPSS Version 24.0 to determine appropriate descriptive statistics to describe our data. The Shapiro-Wilk test for normality revealed that data for two specialties, ACCS and Ophthalmology, were non-normally distributed, so the median was used to describe all data.

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Linear correlation was used to compare the median weeks spent in a specialty at medical school with both the number of CT1/ST1 posts in 2016 and the number of nationwide CT1/ST1 job applications. A Pearson correlation coefficient was calculated for both relationships using SciPy.

Finally, a univariate general linear model was used to analyse the relationship between the number of weeks spent in a specialty at medical school and the number of applicants from that medical school applying to each of the CT1/ST1 specialties.

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RESULTS

Current clinical curricula at UK undergraduate medical schools

Our FOI requests gathered responses that detailed placement time for all clinical years from 25 of the 30 undergraduate medical schools in the UK. Three of the five remaining schools had sufficiently detailed information on their websites for our analysis. Two medical schools were excluded due to insufficient data, leaving 28 medical schools in our analysis.

UK medical students spend a median of 84.5 weeks in clinical training, with a wide variation between medical schools (range 53-92, Figure 2).

During this time, a median of 28 (IQR 22-34) weeks is spent in medical specialties,14.8 (IQR 11-18) weeks in surgical specialties, and eight (IQR 5-10) weeks in general practice (Figure 3). The remaining time is spent on Obstetrics and Gynaecology, Paediatrics, and Psychiatry (six weeks each), Ophthalmology (one week; Figure 3) and other specialties.

Notably, most medical schools had several weeks that could not be classified, as the information provided by the medical school was unclear, or it varied between students, such as in student-selected components (also known as 'special study modules') or F1 shadowing/student assistantships. Medical schools had a median of 5.2 weeks in this "Unknown" category.

From the available data it appeared that some specialties lacked dedicated time within the curricula of most medical schools. Notably, only 11 schools reported dedicated time in Anaesthetics, only 6 for public health and 3 for clinical radiology. None of the medical schools allocated any time in histopathology.

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Medical school exposure and number of CT1/ST1 training posts

There was no correlation between the median length of time spent in a specialty at medical school and the number of training posts available in that specialty at CT1/ST1 level ($R = 0.43$, $p = 0.16$, Figure 4).

A notable outlier here is General Practice, with a much higher proportion of jobs (3802 posts, 43% of all CT1/ST1 jobs) available compared to number of weeks spent on clinical attachment at medical school (median eight weeks; less than 10% of time in the clinical years of medical school).

Medical school exposure and number of CT1/ST1 applications

Using nationwide data on the number of applications received to CT1/ST1 specialties, we found no correlation between the number of *applicants* to a specialty training programme and the median length of time spent in that specialty ($R=0.49$, $p=0.11$), or the competition ratio for that specialty ($R=-0.38$, $p=0.22$).

Medical school exposure and number of alumni entering CT1/ST1 specialty training

We created a general linear model based on a univariate analysis of variance of our dataset, with the specialty as a confounder. This model accounts for 78% of the variance in the percentage of graduates from a medical school picking a specialty ($R^2=0.78$, $p<0.001$). However, the majority of the variance was accounted for by the specialty, while the number of weeks spent in medical school on the subject did not affect our dependent variable (regression ß coefficient= 0.083, p=0.077; Figure 5).

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DISCUSSION

We found that the clinical curriculum in medical schools across the country varies widely, both in the total number of weeks spent in clinical education, and in how this time was divided among different clinical specialties. This division of time in medical school did not appear to correlate with the number of posts available at CT1/ST1 level. However, we found no evidence that spending more weeks on a specialty placement at medical school had any effect on a students' likelihood of choosing that subject at CT1/ST1 level.

Compared with the percentage of CT1/ST1 jobs available, students spent a disproportionately long time in medical school on Obstetrics & Gynaecology (O&G) and Surgical specialties. Conversely, general practice (GP) was under-represented, with students spending a median of 8 weeks (9%) on GP placements, even though over 40% of CT1/ST1 posts were in general practice. Similarly, students spent less time in the Acute Care Common Stem specialties than the number of CT1 jobs would imply appropriate, and 17 schools did not report any formal time in Anaesthetics.

We also found that the majority of medical schools did not spend any specific clinical time on Radiology, Histopathology, or Public Health. It may be argued that much of the content of these specialties is covered in pre-clinical and extra-clinical education, and some specialties have greater crossover than others - for example, radiology is interwoven into most other specialties; positive exposure to obstetrics could make a student more sympathetic to surgery in general; end of life experiences across all specialties could encourage an interest in palliative medicine. However, their exclusion may force many students to seek exposure during taster weeks in the Foundation years if they wish to experience the day-to-day life of doctors in these specialties. This is significant as data from UKFPO (2016) show that 62% of

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doctors do not change their first preference of specialty training programme over the course of their Foundation years [15]. Of those that do, 19.7% preferred a different specialty, rather than being deterred from their original choice due to a negative rotation (3%) or due to a change in personal circumstances (7.8%) [15]. Additionally, some competitive specialties such as neurosurgery usually require a rich CV with multiple publications in order to secure a training number, which may be hampered by insufficient exposure during medical school. Overall, however, our data suggest that relative exclusion or overemphasis of specialties does not appear to affect career decisions. This is contrary to previous studies that used survey responses after medical school placements [5,8–10].

Our results also differ from a study conducted by Alberti et al. using data from doctors starting GP training in 2014 & 2015, which had reported a significant association between the quantity of “authentic” general practice teaching in medical school (defined as teaching in a practice with patient contact) and the percentage of graduates entering GP training [4]. We looked at all specialty training programmes, including GP training, and found no association. This difference may be explained by a number of factors. Firstly, the observed association was weak; Alberti reported correlation coefficients of 0.41 and 0.3 for 2014 and 2015 respectively. Additionally, a statistically significant association (defined without correction for multiple analyses at p=0.05) was only found in the subgroup analysis for “authentic general practice teaching”; there was no significant association between the total general practice teaching exposure in medical school and F2 graduates entering GP training programmes.

This result does not exclude the possibility that time spent on specialty rotations does affect career preference, rather that whatever that effect may be did not translate to a measurable

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change in specialty training choice in our study. Any effect may also be masked by other factors. For example, some students may be dissuaded from doing a specialty after placement time, or doing a placement may encourage students to choose a specialty, but in a non-linear way - such that doing 10 weeks may be no more influential than doing one week. As reported in Burford et al. when investigating student interest in the brain-related specialties, factors such as a negative experience on placement were self-reported as deterrents, but additional factors such as positive experiences during intercalated degrees may be influential [16].

We believe our study is the first to consider actual career destinations of all UK CT1/ST1 doctors in a single year group cohort and attempt to correspond these with the clinical curricula of their medical school. We acquired unpublished data directly from every medical school in the UK and Health Education England, and hope this resource may be helpful for educators and students.

However, there were several limitations in our methodology. Firstly, we looked at 2016/17 data for the medical school curricula, and 2016 data for CT1/ST1 jobs. However, doctors applying in the 2016 cycle would have completed medical school in 2014. The curricula at their medical school may have changed in that time.

Secondly, we looked at just one year's worth of data, while the number of doctors entering each training programme changes significantly year-on-year. Between 2012 and 2017, although there was just a 1.7% increase in overall numbers of doctors in training programmes, the number of intensive care trainees tripled, and emergency medicine doubled, but Obstetrics & Gynaecology and Psychiatry dropped, by around 8%. Furthermore since our data were from UKFPO's report on destinations after F2, we do not have information on the specialties

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chosen by the 50.4% of doctors who did not directly enter specialty training after F2. These graduates may disproportionately be those attempting to enter competitive specialties, or doctors who are still undecided between multiple specialties.

Thirdly, every medical school has some time allocated for student-selected components (special study modules), or assistantships. The specialties involved in these components of clinical courses would vary from student to student, and so we could not categorically allocate it to any individual specialty. A median of 5.2 weeks (IQR 3.6-12) is spent on this "Unknown" category, and for some students this will have included specialties we thought were under- or over-represented. Indeed, student-selected components are frequently chosen in the specialties students most think they wish to do in the future, and therefore this "Unknown" may hide the most formative weeks in a student's clinical education.

Finally, we do not have a breakdown of which specialty each doctor *applied to* for their CT1/ST1 job based on their medical schools. The application process is competitive, so even if spending longer on a placement increased an applicant's desire to enter a specialty, this may not show itself in the numbers of candidates who were successful. We do note however that on a nationwide scale, the specialties that that are oversubscribed at CT1/ST1 level are not those that are over-represented in medical school [15].

Conclusion

UK medical school curricula are heterogeneous, with different universities allocating often vastly different amounts of time to different specialties. It does not appear that across the UK as a whole the amount of time spent in different specialties correlates with the number of specialty training posts available at CT1/ST1 level. Furthermore, our analyses suggest that the

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amount of time spent in different specialties at medical school does not appear to increase the likelihood of graduates from that medical school entering that specialty.

Our data challenges the perception that increasing specialty exposure enhances recruitment. This raises questions about whether curriculum adjustments focusing solely on length of time in certain settings will help to tackle the recruitment crises going forward.

What is already known on this topic

The NHS is facing unprecedented recruitment pressures. It has been suggested, primarily through the use of student surveys of career intentions and/or attitudes, that increasing exposure to specialties at medical school may increase the likelihood of students later choosing that specialty. Based on this, it is argued that medical school curricula should be more appropriately tailored to the recruitment demands of the 21st century.

What this paper adds

Our study found no correlation between exposure to a specialty at medical school and the likelihood of graduates applying to or entering that specialty at CT1/ST1 level. This therefore challenges the prevailing view that increasing specialty exposure enhances recruitment.

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FIGURE LEGENDS

Figure 1: Sorting of ACCS Specialities according to individual analyses

Figure 2: Total time in clinical training in UK undergraduate medical schools

Figure 3: Box plots showing median length of time spent at medical school in different clinical specialities, with whiskers showing range. *Medicine includes Acute Medicine & Critical Care.

Figure 4: Scatter plot comparing median number of weeks spent on a speciality at medical school and CT1/ST1 posts available for that specialty.

Figure 5: Scatter plot comparing number of weeks spent in a specialty at medical school, with the percentage of graduates from that medical school who entered that specialty after F2.

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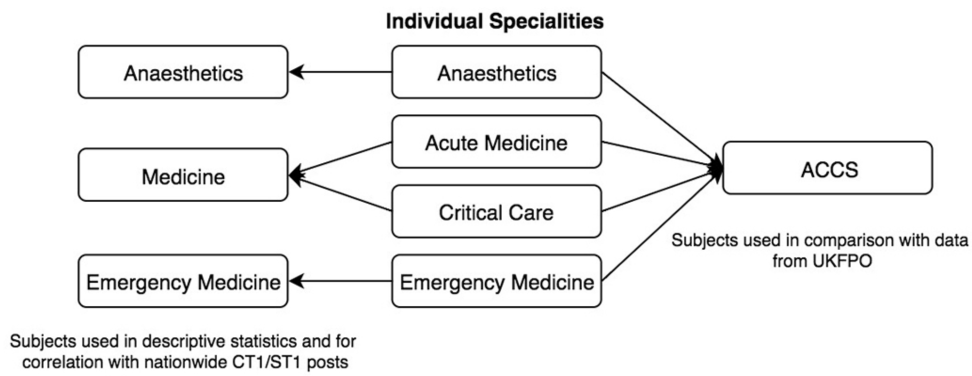

Figure 1: Sorting of ACCS Specialities according to individual analyses

90x34mm (300 x 300 DPI)

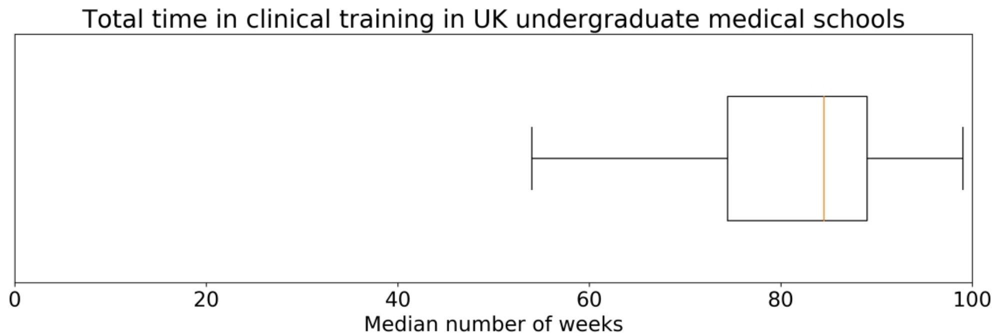

Figure 2: Total time in clinical training in UK undergraduate medical schools

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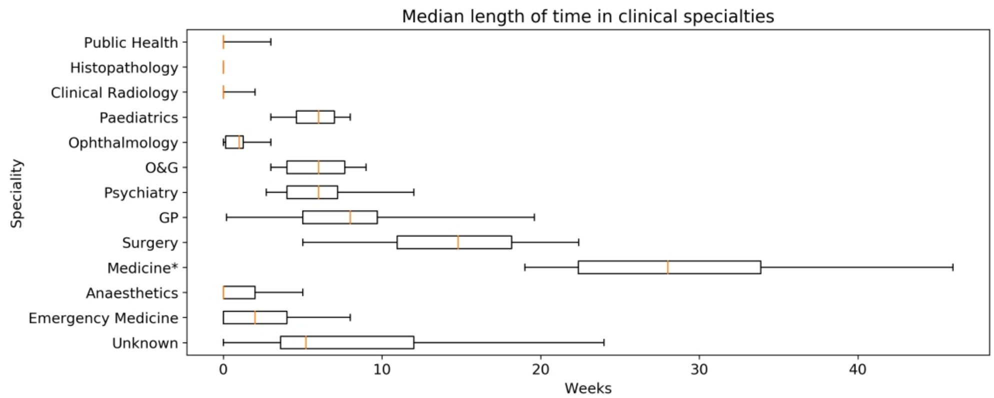

Figure 3: Box plots showing median length of time spent at medical school in different clinical specialities, with whiskers showing range. *Medicine includes Acute Medicine & Critical Care.

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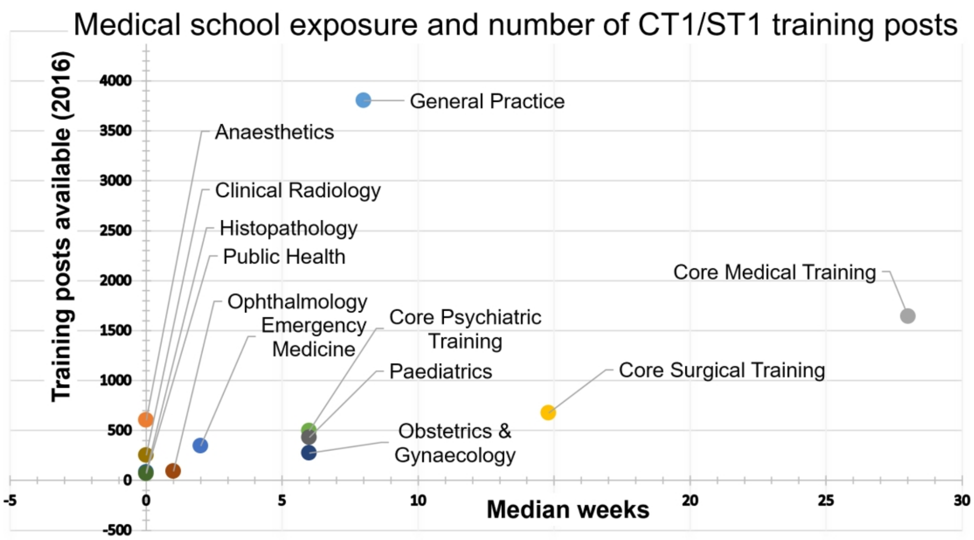

Figure 4: Scatter plot comparing median number of weeks spent on a speciality at medical school and CT1/ST1 posts available for that specialty.

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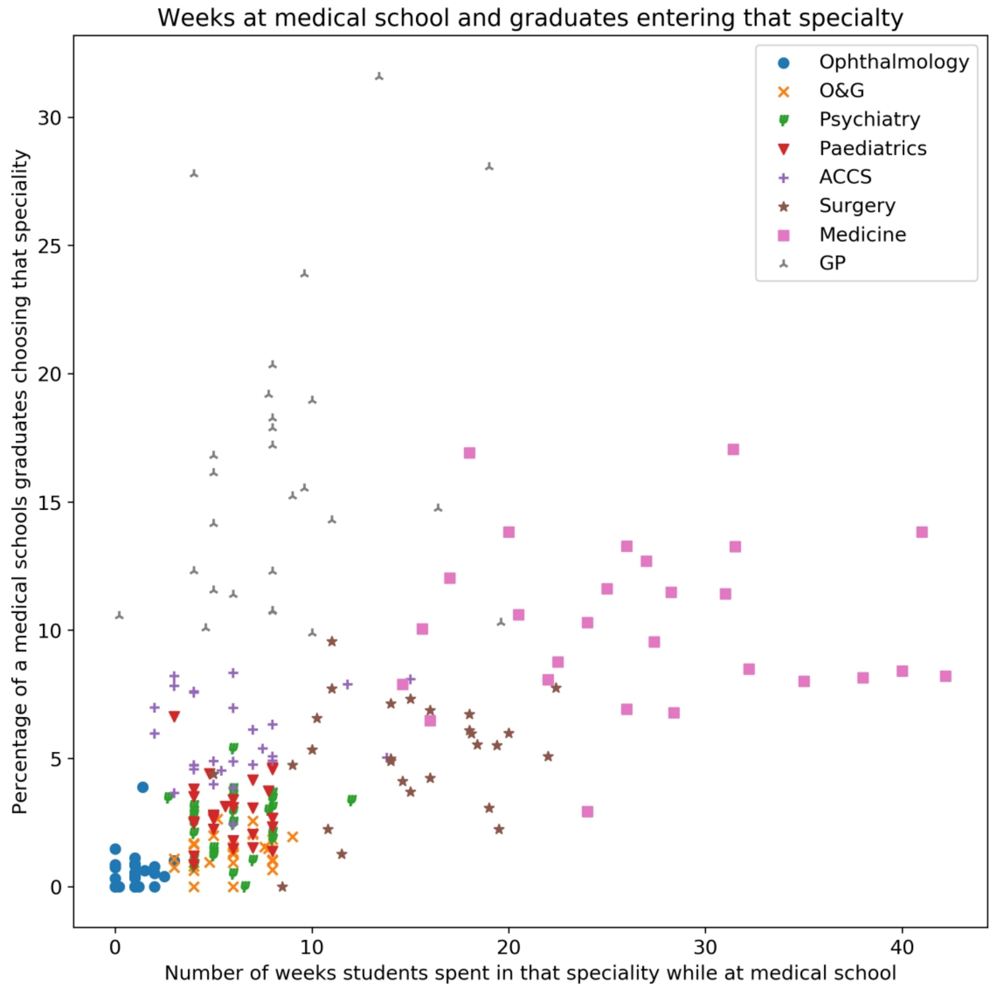

Figure 5: Scatter plot comparing number of weeks spent in a specialty at medical school, with the percentage of graduates from that medical school who entered that specialty after F2.

215x214mm (300 x 300 DPI)

Appendix

FREEDOM OF INFORMATION REQUESTS:

To universities:

Dear [University],

My enquiry relates to your undergraduate Medicine course.

I am seeking information on:

- How much time medical undergraduates spend on "placement" in each of the medical specialties as part of their clinical education.

I would be very grateful if this information could be provided as accurately as is possible - in months, weeks or days depending on the length of time.

I would prefer if this information could be broken down as much as possible - so if, for example, you have a broadly titled 'Neurology, Ophthalmology and Psychiatry' rotation, please provide information broken down by specialty (e.g. Neurology - 1 month, Psychiatry - 1 month, Ophthalmology - 1 week.)

If you are unable to provide me with this information to the level of detail requested, I would appreciate it if you could give me the information with as much detail as is possible.

Thank you very much for your assistance - I really appreciate it.

Yours faithfully,

Ms Alexander

To the UK Foundation Programme Office:

I have read with interest your published careers destination report for 2016, particularly appendices B and D where the destinations are broken down by medical school. Appendix D shows % appointed to specialty training, GP training and Psychiatry training respectively. Do you have that data broken into what specialty training programme the F2s were appointed to i.e Core Medical Training vs Obs and Gynae vs Paeds etc? If you do and it is possible, would you be able to send me that information?

Final year medical student, Alexander Emery

HEE specialty	**Subjects in medical school curricula combined**
Anaesthetics	Anaesthetics*
Clinical Radiology	Clinical Radiology
Core Medical Training	**Acute Medicine*** **Critical Care*** General Medicine, Cardiology, Respiratory, Haematology, Oncology, Palliative care, Rheumatology, Endocrinology, Neurology, Stroke, GUM/Sexual, Care of the Elderly, Dermatology, Infectious Diseases, Hepatology, Gastroenterology, Nephrology
Core Psychiatry training	Psychiatry

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Core Surgical Training	**Cardiothoracic surgery** **Oral & Maxillofacial surgery** **Neurosurgery** General surgery, Breast, Gastrointestinal, Vascular, Orthopaedics, Plastics, Urology, Trauma, ENT
Emergency Medicine	Emergency Medicine*
General Practice	General Practice
Histopathology	Histopathology
Paediatrics	Paediatrics
Public Health	Public Health
Obstetrics & Gynaecology	Obstetrics & Gynaecology Women's Health
Ophthalmology	Ophthalmology

Table A1: shows how individual components of different medical school curricular were combined for purposes of analysis. * = ACCS specialties.

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STROBE Statement

		Recommendation	Page Number
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6-7
Objectives	3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	4	Present key elements of study design early in the paper	1
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	8
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-10

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Bias	9	Describe any efforts to address potential sources of bias	8-9
Study size	10	Explain how the study size was arrived at	8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9-10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9-10
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	9-10
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	N/A
		(b) Indicate number of participants with missing data for each variable of interest	11

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Outcome data	15*	Report numbers of outcome events or summary measures	N/A
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11-12
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	13-14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14-16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	16-17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	1

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*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Clinical specialty training in UK undergraduate medical schools: a retrospective observational study

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Contributor Statement:
HJV, AWE and AJM conceived of the study and its design. ECA and AWE completed initial data collection and HJV, AWE and AJM completed data extraction. MB and HJV completed the statistical analysis and CB assisted. HJV and AWE wrote the majority of the first draft, and the other authors contributed to refine it. All authors then contributed to refine and review the final draft and gave their consent for submission.

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Competing interests:

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Data sharing:

Raw data used to complete this study is available from the authors on request.

ABSTRACT

Objectives

To determine if increased exposure to clinical specialties at medical school is associated with increased interest in pursuing that specialty as a career after foundation training.

Design

A retrospective observational study.

Setting

31 UK medical schools were asked how much time students spend in each of the clinical specialties. We excluded two schools that were solely Graduate Entry, and two schools were excluded for insufficient information.

Main outcome measures

Time spent on clinical placement from UK undergraduate medical schools, and the training destinations of graduates from each school. A general linear model was used to analyse the relationship between the number of weeks spent in a specialty at medical school and the percentage of graduates from that medical school entering each of the CT1/ST1 specialties directly after FY2.

Results

Students spend a median of 85 weeks in clinical training. This includes a median of 28 weeks on medical firms, 15 weeks in surgical firms, and 8 weeks in general practice (GP). In general, the number of jobs were proportionate to the number of weeks spent in medical school, with some notable exceptions including General Practice. Importantly, we found that

the number of weeks spent in a specialty at medical school did not predict the percentage of graduates of that school training in that specialty at CT1/ST1 level (ß coefficient= 0.061, p=0.228).

Conclusions

This study found that there was no correlation between the percentage of FY2 doctors appointed to a CT1/ST1 specialty and the length of time that they would have spent in those specialties at medical school. This suggests that curriculum adjustments focusing solely on length of time spent in a specialty in medical school would be unlikely to solve recruitment gaps in individual specialties.

<u>Strengths and limitations of this study</u>

- This study synthesises a large dataset on the amount of time spent in clinical specialties for students in 27 of the 29 UK undergraduate medical schools, using a novel and reproducible method of data collection (freedom of information requests) to demonstrate a marked heterogeneity amongst UK medical school curricula.
- Rather than relying on subjective metrics such as questionnaires to determine what motivated junior doctor career decisions, we looked at actual successful career decisions for 2672 doctors, and used an objective metric (the time schools allocate to specialities) to examine the role specialty exposure plays in career decision making for all clinical specialties available at CT1/ST1 level.
- Among the limitations, this study collected data on curricula and of the speciality decisions of doctors entering CT1/ST1 in 2016, although these doctors would have completed medical school in 2014.

- This study only considered graduates who entered CT1/ST1 directly after FY2, and therefore there is missing data for approximately half of all doctors; the factors influencing these doctors on speciality decisions may differ significantly. We also do not have data on which specialty doctors *applied to* for their CT1/ST1 jobs, only the specialty they obtained a job in.

- The impact of student-selected components or assistantships, and any exposure to specialties during the "pre-clinical" portion of medical teaching, could not be assessed, although the weeks spent in these placements may influence career choice.

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INTRODUCTION

The NHS is facing unprecedented recruitment pressures, particularly in areas such as General Practice (GP). In 2015, the Department of Health set a specified target to recruit an extra 5000 GPs by 2020[1]. However, there are concerns this target may not be met [2]. Other areas are also facing pressures, notably psychiatry and emergency medicine [3]. It has been suggested that increasing exposure to these specialties at medical school may help increase recruitment[4–9]. We wished to investigate this hypothesis.

After medical school, doctors in the UK enter a two-year Foundation programme (FY1, FY2), the completion of which allows entry into a specialty training programme after a competitive application process. Approximately half of FY2 doctors progress directly into these training programmes, whilst the other half take time out or do not continue postgraduate training. Further specialty training takes the form of Core Training (CT1) or Specialty Training (ST1) programmes. Core training programmes are generally two years long, and trainees then progress into specialty training programmes (ST3), whereas specialty training programmes run straight through from ST1 to completion of training.

Several factors may influence the specialty that doctors choose to enter, including personality traits, perceptions of the work-life balance, length of training, and quality of placements during medical school[10]. These have generally been studied through questionnaires of medical students or junior doctors. Outside of the UK, studied approaches to increase recruitment to hard-to-recruit specialities or rural areas have included placing students local to home, early sign-ups for medical internships, and mentoring [4–6], with some studies suggesting that positive rural placements lead to increased interest in rural practice [7,8]. Within the UK, it has also been suggested that length of exposure to a medical specialty at medical school influences career choice [9,11–15]. Based on this, it is argued that medical school curricula should be more appropriately tailored to the recruitment demands of the 21st century.

Recent research appears to have identified an association between the quantity of clinical GP teaching at medical school and entry into UK general practice training; Alberti (2017) found that there was a statistically significant association between the quantity of general practice training and the percentage of graduates entering the general practice training pathway after FY2[9]. However other specialties have not, to our knowledge, been examined in the same way. The majority of other evidence supporting the suggestion that exposure determines later choices comes from surveys conducted during medical school, where students are asked either about their interest in pursuing a specialty after having been exposed to that specialty on placement [11,14,15], or about their perceptions or attitude to that specialty as a whole [16]. However, preferences at this point may be transient [17] and so not actually have an impact on future career decisions. Furthermore, historical trends do not appear to show that progressive increases in exposure to General Practice over the last 30 years [6] have correlated with an increase in the proportion of UK graduates entering general practice [18].

In the UK, the General Medical Council supports and regulates medical education, and is responsible for quality assurance. Medical schools are free to design their own curricula, and guidance prior to 2016 [19] stated that these curricula must be structured to include a range of specialties, *"including medicine, obstetrics and gynaecology, paediatrics, surgery, psychiatry and general practice"*. However, since January 2016, when *Tomorrow's Doctors* [19] was superseded by *Promoting excellence* [20], the guidance on the clinical specialties that students must be exposed to has become more generalised - now simply stating that "*medical school* *curricula must give medical students experience in a range of specialties, in different settings, with the diversity of patient groups that they would see when working as a doctor (R5.3b).”*

We wanted to understand the current exposure to different medical specialties at UK undergraduate medical schools and examine how this compared with the number of posts available at CT1/ST1. We also wanted to examine the relationship between exposure to clinical specialties at medical school and the percentage of each school’s graduates being appointed to each postgraduate CT1/ST1 specialty training programme directly after FY2.

METHODS

Data collection

Freedom of Information (FOI) requests were sent to all 29 UK undergraduate medical schools asking how much time students spend on placement in each of the medical specialties as part of their clinical education. We excluded schools that were solely Graduate Entry due to differences in the structure of their curricula, and we also excluded recently-established schools who had not yet produced medical graduates. Where data were missing, or medical schools did not respond, we accessed university websites (March 2017) to obtain as complete a dataset as possible.

An additional FOI request was sent to Health Education England to determine the medical school attended by each doctor entering a specialty training programme immediately after foundation training in 2016. This used the self-declared appointments of FY2 doctors completing the mandatory National F2 Career Destination Survey 2016. Approximately half of these doctors did not enter any specialty training programme at this point.

Finally, we accessed publicly available data on 2016 specialty training posts and applications from the Health Education England website.

Patient and Public Involvement

There was no formal involvement of patients or the public in this study.

Data cleaning

Data were collated into a spreadsheet and analysed with Microsoft Excel 2016, SPSS Version 24.0, and SciPy (Scipy 0.19.1, python 3.6.0).

Any medical schools for which we could only classify a number of weeks less than one interquartile range below the lower quartile (Q1 - IQR) were excluded due to insufficient data. The names and scope of individual curricula components differed between medical schools. We therefore standardised the curricula based on the training programmes offered by Health Education England (HEE) so that appropriate curriculum components were linked with their relevant CT1/ST1 specialty (Appendix Table A1). As very few medical schools offered cardiothoracic surgery, maxillofacial surgery, or neurosurgery specifically, and all three are available at both ST1 and ST3 level, we combined these into Surgery.

Special attention is drawn to the components of the Acute Care Common Stem programme (ACCS): Emergency Medicine, Anaesthetics, Critical Care, Acute Medicine. The latter two of these were combined into Medicine for the first part of the analysis, as this is how Health Education England group the subjects. However, for the final part of our analysis, specialty information from the survey carried out by UKFPO was provided with data grouped as "Acute Care Common Stem (ACCS)" and "Anaesthetics". We collated both into a single "ACCS" specialty, and compared this with a composite category from our curricula data with all four ACCS components (Figure 1).

Statistical models

A Shapiro Wilk test for normality was performed using SPSS Version 24.0 to determine appropriate descriptive statistics to describe our data. The Shapiro-Wilk test for normality revealed that data for two specialties, ACCS and Ophthalmology, were non-normally distributed, so the median was used to describe all data.

A general linear model was used to analyse the relationship between the number of weeks spent in a specialty at medical school and the percentage of FY2 graduates from that medical school entering each of the CT1/ST1 specialties.

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RESULTS

Current clinical curricula at UK undergraduate medical schools

Our FOI requests gathered responses that detailed placement time for all clinical years from 24 of the 29 established undergraduate medical schools in the UK. Three of the five remaining schools had sufficiently detailed information on their websites for our analysis. The remaining two medical schools were excluded due to insufficient data, leaving 27 medical schools in our analysis.

UK medical students spend a median of 85 weeks in clinical training, with a wide variation between medical schools (range 64-99, Figure 2).

During this time, a median of 28 (IQR 22-35) weeks is spent in medical specialties, 15 (IQR 11-18) weeks in surgical specialties, and eight (IQR 5-10) weeks in general practice (Figure 3). The remaining time is spent on Obstetrics and Gynaecology, Paediatrics, and Psychiatry (six weeks each), Ophthalmology (one week; Figure 3) and other specialties.

Notably, most medical schools had several weeks that could not be classified, as the information provided by the medical school was unclear, or it varied between students, such as in student-selected components (also known as 'special study modules') or FY1 shadowing/student assistantships. Medical schools had a median of 5.2 weeks in this "Unknown" category.

From the available data it appeared that some specialties lacked dedicated time within the curricula of most medical schools. Notably, of 27 schools, only 10 reported dedicated time in

Anaesthetics, only 6 for public health and 3 for clinical radiology. None of the medical schools allocated any clinical time specifically to histopathology that was labelled as such.

Median medical school exposure and number of CT1/ST1 training posts and applications

We first examined the median exposure to a specialty across all medical schools, and compared this with the total nationwide number of training posts available in that specialty at CT1/ST1 level (Figure 4). Excluding General Practice, there is a statistically significant positive relationship between the median length of time spent in a specialty at medical school and the number of training posts available in that specialty at CT1/ST1 level. General Practice is notable for having a much higher proportion of jobs available (3802 posts, 43% of all CT1/ST1 jobs) compared to the number of weeks spent on clinical attachment at medical school (median eight weeks; less than 10% of time in the clinical years of medical school). To better visualise specialties that were comparatively over- or under-represented at medical school, we have plotted a line of best fit for all hospital specialties (i.e. excluding General Practice).

We found similar results when we considered median medical school exposure and the total number of *applications* to CT1/ST1 posts (Appendix Figure 1).

Medical school exposure and number of alumni entering CT1/ST1 specialty training after FY2

The data obtained from Health Education England included 6752 respondents from 34 UK medical schools and categories for non-UK EEA and non-EEA schools. Of these, 3231 doctors (47.85%) reported that their next destination was Specialty training in the UK. Non-

UK and graduate medical schools were excluded, as were those responses that were left blank. This left 2672 responses. These results were normalised with the total number of respondents as the denominator, to give the percentage of respondents from each included medical school that picked a particular specialty. This was then compared with the number of weeks that students from that medical school spend on that specialty.

A generalised linear model was fitted to investigate the relationship between medical school exposure and number of alumni entering speciality training. The dependent variable was the percentage of graduates from each medical school who entered a specialty after FY2, and the independent variables were the number of weeks during medical school spent on that speciality, the speciality, and the medical school. Our model shows the number of weeks of training does not have any impact on the percentage of alumni choosing the speciality (ß coefficient= 0.061, p=0.228).

A scatter plot (Figure 5) visualises this this relationship. Overall, there is a clear correlation between the number of weeks spent on a specialty and the percentage of doctors picking that specialty after FY2: medical students spend more weeks in specialties that have more jobs. However, looking at any individual specialty, there is no association; i.e. changing the number of weeks spent on a specialty between medical schools has no impact on the percentage of FY2 doctors entering that specialty.

DISCUSSION

We found that the clinical curriculum in medical schools across the country varies widely, both in the total number of weeks spent in clinical education, and in how this time was divided among different clinical specialties. This division of time in medical school is generally proportional with the number of posts available at CT1/ST1 level, with the notable exception of General Practice. However, we found no evidence that spending more weeks on a specialty placement at medical school had any effect on a students' likelihood of entering that subject at CT1/ST1 level.

Compared with the percentage of CT1/ST1 jobs available, students spent a disproportionately long time in medical school on Obstetrics & Gynaecology (O&G) and Surgical specialties. Conversely, general practice (GP) was under-represented, with students spending a median of 8 weeks (9%) on GP placements, even though over 40% of CT1/ST1 posts were in general practice. Similarly, students spent less time in the Acute Care Common Stem specialties than the number of CT1 jobs would imply is appropriate, and 17 schools did not report any formal time in Anaesthetics.

We also found that most medical schools did not allocate and label any specific clinical time on Radiology, Histopathology, or Public Health. It may be argued that much of the content of these specialties is covered in pre-clinical and extra-clinical education, and some specialties have greater crossover than others - for example, radiology is interwoven into most other specialties; positive exposure to obstetrics could make a student more sympathetic to surgery in general; end of life experiences across all specialties could encourage an interest in palliative medicine. Similarly, the disproportionally low amount of time spent on GP placement may simply be because many of the diseases and treatments experienced in GP are also encountered across the various hospital specialties.

However, their exclusion may force many doctors to seek exposure during taster weeks in the Foundation years if they wish to experience the day-to-day life of doctors in these specialties. This is significant as data from UKFPO (2016) show that 62% of doctors do not change their first preference of specialty training programme over the course of their Foundation years [21]. Of those that do, 19.7% preferred a different specialty, rather than being deterred from their original choice due to a negative rotation (3%) or due to a change in personal circumstances (7.8%) [21]. Additionally, some competitive specialties such as neurosurgery usually require a rich CV with multiple publications in order to secure a training number, which may be hampered by insufficient exposure during medical school. Overall, however, our data suggest that relative exclusion or overemphasis of specialties does not appear to affect career decisions. This is contrary to previous studies that used survey responses after medical school placements [11,14–16].

Our results also differ from a study conducted by Alberti et al. using data from doctors starting GP training in 2014 & 2015, which had reported a significant association between the quantity of “authentic” general practice teaching in medical school (defined as teaching in a practice with patient contact) and the percentage of graduates entering GP training [9]. We looked at all specialty training programmes, including GP training, and found no association. This difference may be explained by a number of factors. Firstly, a statistically significant association (defined without correction for multiple analyses at p=0.05) was only found in the subgroup analysis for “authentic general practice teaching” whereas our analysis may have also captured non-clinical speciality exposure during clinical years, for example through small group teaching. Secondly, the observed association was weak; Alberti reported correlation coefficients of 0.41 and 0.3 for 2014 and 2015 respectively.

This result does not exclude the possibility that time spent on specialty rotations does affect career preference, rather that whatever that effect may be did not translate to a measurable change in specialty training choice in our study. Any effect may also be masked by other factors. For example, some students may be dissuaded from doing a specialty after placement time, or doing a placement may encourage students to choose a specialty, but in a non-linear way - such that doing 10 weeks may be no more influential than doing one week. As reported in Burford et al. when investigating student interest in the brain-related specialties, factors such as a negative experience on placement were self-reported as deterrents, but additional factors such as positive experiences during intercalated degrees may be influential [22].

We believe our study is the first to consider actual career destinations of all UK CT1/ST1 doctors in a single year group cohort and attempt to correspond these with the clinical curricula of their medical school. We acquired unpublished data directly from nearly all medical schools in the UK from Health Education England, and hope this resource may be helpful for educators and students.

There were several limitations in our methodology. Firstly, we looked at 2016/17 data for the medical school curricula, and 2016 data for CT1/ST1 jobs. However, doctors applying in the 2016 cycle would have completed medical school in 2014. The curricula at their medical school may have changed in that time.

Secondly, we looked at just one year's worth of data, while the number of doctors entering each training programme changes significantly year-on-year. Between 2012 and 2017, although there was just a 1.7% increase in overall numbers of doctors in training programmes, the number of intensive care trainees tripled, and emergency medicine doubled, but Obstetrics & Gynaecology and Psychiatry dropped, by around 8%. Furthermore since our data were from UKFPO's report on destinations after F2, we only have information on doctors who are directly progressing to ST1/CT1 immediately after F2. We do not have information on the specialties chosen by the 50.4% of doctors who did not directly enter specialty training after F2. These graduates may disproportionately be those attempting to enter competitive specialties, or doctors who are still undecided between multiple specialties, and therefore the speciality decisions of these doctors remain unknown.

Thirdly, it is possible that some exposure to certain specialities was not captured by our study. Every medical school we studied had some time allocated for student-selected components (special study modules), or assistantships. The specialties involved in these components of clinical courses would vary from student to student, and so we could not categorically allocate it to any individual specialty. A median of 5.2 weeks (IQR 3.6-12) is spent on this "Unknown" category, and for some students this will have included specialties we thought were under- or over-represented. Indeed, student-selected components are frequently chosen in the specialties students most think they wish to do in the future, and therefore this "Unknown" may hide the most formative weeks in a student's clinical education.

In addition, it should be mentioned that some medical schools are moving towards earlier clinical contact even from the first year. This is particularly the case for General Practice where some schools conduct visits once a week during the traditionally 'preclinical' years.

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Depending on how universities interpreted our request, such exposure could have been missed.

Finally, we do not have a breakdown of which specialty each doctor *applied to* for their CT1/ST1 job based on their medical schools. The application process is competitive, so even if spending longer on a placement increased an applicant's desire to enter a specialty, this may not show itself in the numbers of candidates who were successful. We do note however that on a nationwide scale, the specialties that that are oversubscribed at CT1/ST1 level are not those that are over-represented in medical school [21].

Conclusion

UK medical school curricula are heterogeneous, with different universities allocating often vastly different amounts of time to different specialties. Across the UK as a whole, the amount of time spent in medical school on a specialty is approximately proportional with number of specialty training posts available in that specialty, with notable exceptions including GP. However, analyses from our study have suggested that the amount of time spent in different specialties at medical school does not impact on the likelihood of graduates from that medical school entering that specialty after completion of Foundation Training.

Our findings challenge the perception that increasing specialty exposure enhances recruitment and suggest that curriculum adjustments focusing solely on length of time in certain settings will not resolve recruitment gaps going forward.

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FIGURE LEGENDS

Figure 1: Sorting of ACCS Specialities according to individual analyses

Figure 2: Total time in clinical training in UK undergraduate medical schools

Figure 3: Box plots showing median length of time spent at medical school in different clinical specialities, with whiskers showing range. *Medicine includes Acute Medicine & Critical Care.

Figure 4: Scatter plot comparing CT1/ST1 posts available for a specialty and the median number of weeks spent on that speciality at medical school. Line of best fit drawn using all hospital specialties; i.e. excluding General Practice.

Figure 5: Scatter plot comparing number of weeks spent in a specialty at medical school, with the percentage of graduates from that medical school who entered that specialty after F2.

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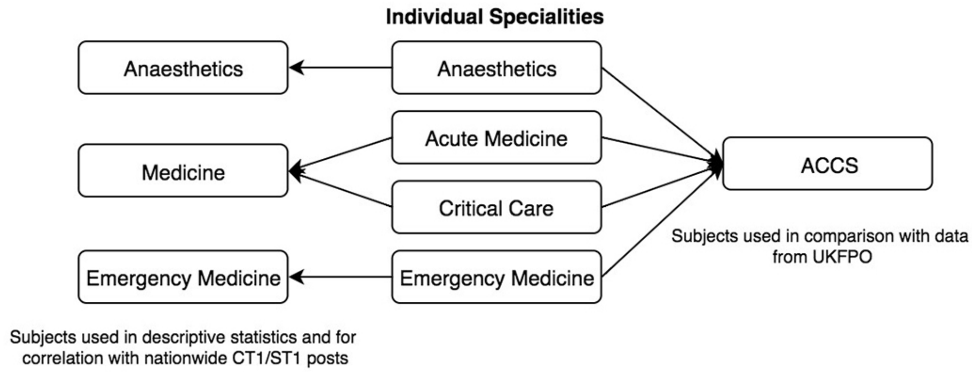

Figure 1: Sorting of ACCS Specialities according to individual analyses

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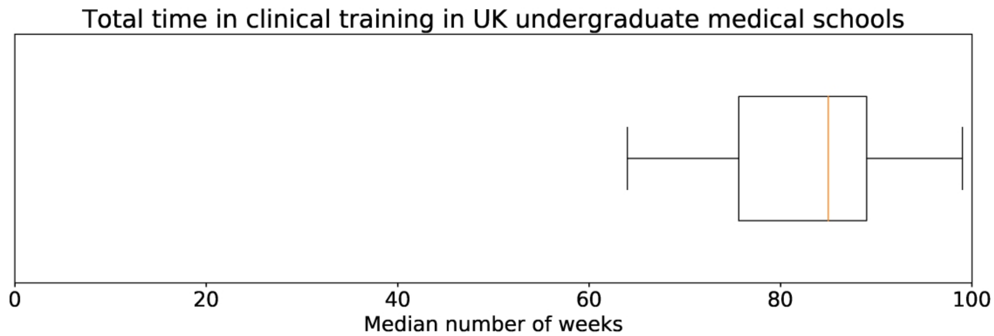

Figure 2: Total time in clinical training in UK undergraduate medical schools

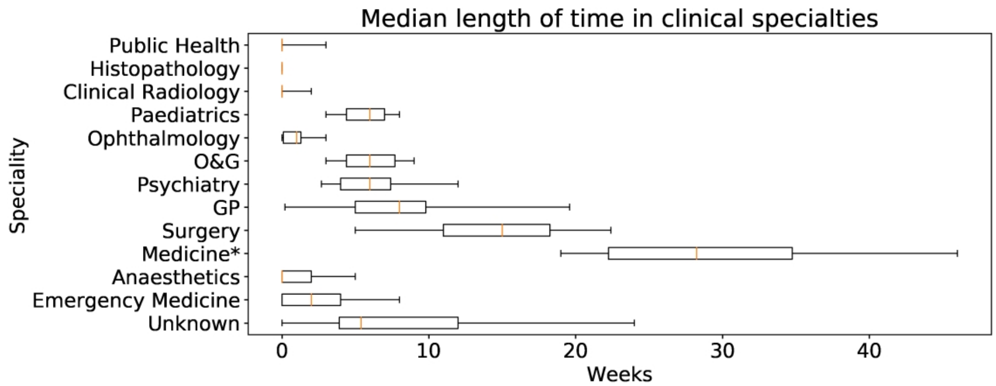

Figure 3: Box plots showing median length of time spent at medical school in different clinical specialities, with whiskers showing range. *Medicine includes Acute Medicine & Critical Care.

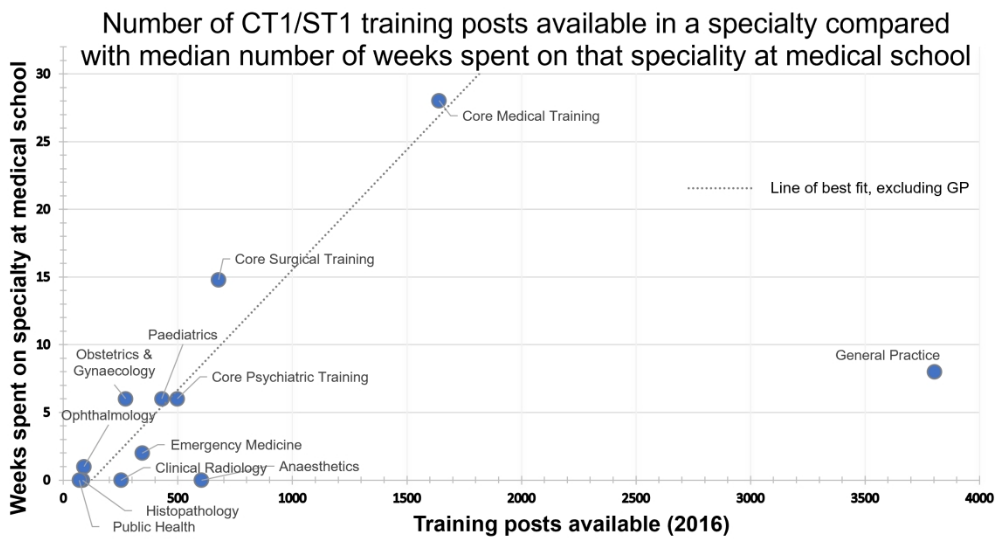

Figure 4: Scatter plot comparing CT1/ST1 posts available for a specialty and the median number of weeks spent on that speciality at medical school. Line of best fit drawn using all hospital specialties; i.e. excluding General Practice.

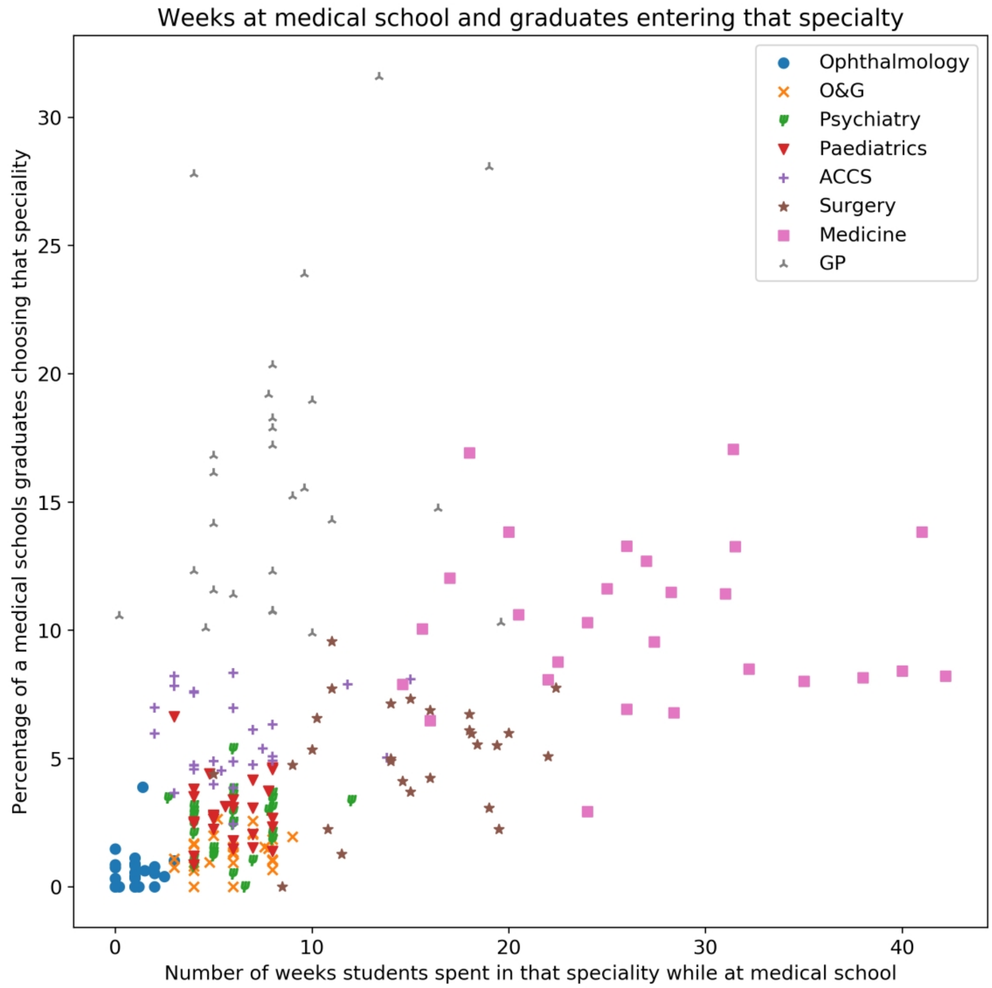

Figure 5: Scatter plot comparing number of weeks spent in a specialty at medical school, with the percentage of graduates from that medical school who entered that specialty after F2.

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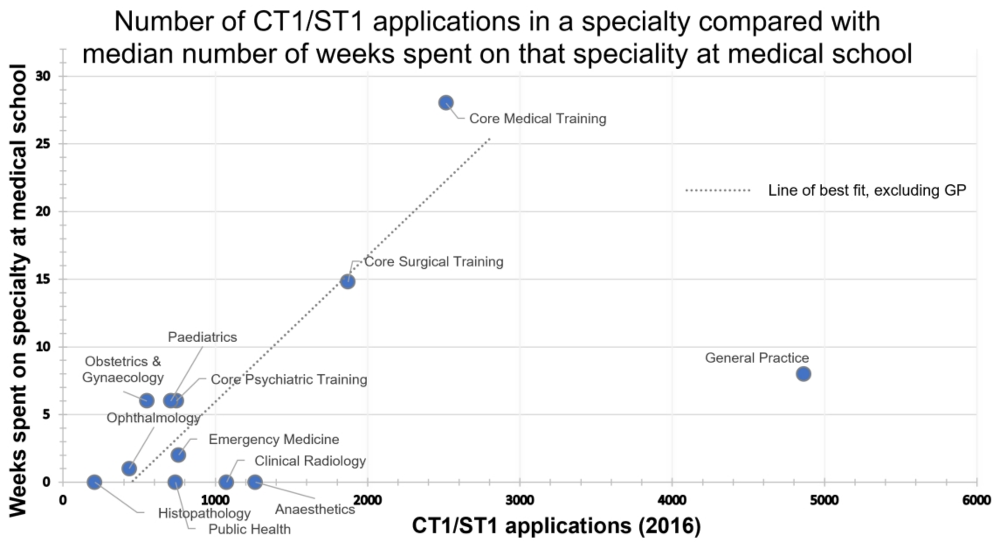

Appendix Figure 1: Scatter plot comparing CT1/ST1 applications for a specialty and the median number of weeks spent on that speciality at medical school. Line of best fit drawn using all hospital specialties; i.e. excluding General Practice.

Appendix

FREEDOM OF INFORMATION REQUESTS:

To universities:

Dear [University],

My enquiry relates to your undergraduate Medicine course.

I am seeking information on:

- How much time medical undergraduates spend on "placement" in each of the medical specialties as part of their clinical education.

I would be very grateful if this information could be provided as accurately as is possible - in months, weeks or days depending on the length of time.

I would prefer if this information could be broken down as much as possible - so if, for example, you have a broadly titled 'Neurology, Ophthalmology and Psychiatry' rotation, please provide information broken down by specialty (e.g. Neurology - 1 month, Psychiatry - 1 month, Ophthalmology - 1 week.)

If you are unable to provide me with this information to the level of detail requested, I would appreciate it if you could give me the information with as much detail as is possible.

Thank you very much for your assistance - I really appreciate it.

Yours faithfully,

Ms Alexander

To the UK Foundation Programme Office:

I have read with interest your published careers destination report for 2016, particularly appendices B and D where the destinations are broken down by medical school. Appendix D shows % appointed to specialty training, GP training and Psychiatry training respectively. Do you have that data broken into what specialty training programme the F2s were appointed to i.e Core Medical Training vs Obs and Gynae vs Paeds etc? If you do and it is possible, would you be able to send me that information?

Final year medical student, Alexander Emery

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HEE specialty	Subjects in medical school curricula combined
Anaesthetics	Anaesthetics*
Clinical Radiology	Clinical Radiology
Core Medical Training	**Acute Medicine*** **Critical Care*** General Medicine, Cardiology, Respiratory, Haematology, Oncology, Palliative care, Rheumatology, Endocrinology, Neurology, Stroke, GUM/Sexual, Care of the Elderly, Dermatology, Infectious Diseases, Hepatology, Gastroenterology, Nephrology
Core Psychiatry training	Psychiatry
Core Surgical Training	**Cardiothoracic surgery** **Oral & Maxillofacial surgery** **Neurosurgery** General surgery, Breast, Gastrointestinal, Vascular, Orthopaedics, Plastics, Urology, Trauma, ENT
Emergency Medicine	Emergency Medicine*
General Practice	General Practice
Histopathology	Histopathology
Paediatrics	Paediatrics
Public Health	Public Health
Obstetrics & Gynaecology	Obstetrics & Gynaecology Women's Health
Ophthalmology	Ophthalmology

Table A1: shows how individual components of different medical school curricular were combined for purposes of analysis. * = ACCS specialties.

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31 **Appendix Figure 1:** Scatter plot comparing CT1/ST1 applications for a specialty and the median number of weeks spent on that speciality at medical school. Line of best fit drawn using all hospital specialties; i.e. excluding General Practice

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STROBE Statement

		Recommendation	Page Number
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6-7
Objectives	3	State specific objectives, including any prespecified hypotheses	8
Methods			
Study design	4	Present key elements of study design early in the paper	1
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9-11

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Bias	9	Describe any efforts to address potential sources of bias	9-11
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	9-10
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12-14
		(b) Give reasons for non-participation at each stage	12-14
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	N/A
		(b) Indicate number of participants with missing data for each variable of interest	11

Outcome data	15*	Report numbers of outcome events or summary measures	N/A
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13-14
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17-19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19
Generalisability	21	Discuss the generalisability (external validity) of the study results	18-19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	1

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*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Clinical specialty training in UK undergraduate medical schools: a retrospective observational study

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Keywords:	MEDICAL EDUCATION & TRAINING, EDUCATION & TRAINING (see Medical Education & Training), PRIMARY CARE

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Clinical specialty training in UK undergraduate medical schools: a retrospective observational study

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Contributor Statement:
HJV, AWE and AJM conceived of the study and its design. ECA and AWE completed initial data collection and HJV, AWE and AJM completed data extraction. MB and HJV completed the statistical analysis and CB assisted. HJV and AWE wrote the majority of the first draft, and the other authors contributed to refine it. All authors then contributed to refine and review the final draft and gave their consent for submission.

Guarantor:
Hrisheekesh J Vaidya serves as the guarantor for this piece. The guarantor affirms that this manuscript is an honest, accurate and transparent account of the study being reported; that no important aspects of the study have been omitted; and that there were no discrepancies from the study as planned.

Ethics approval:
Ethical approval was not required.

Role of the funding source:
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Competing interests:

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Data sharing:

Data were acquired from Freedom of Information requests and from publicly available information provided by Health Education England. The corresponding author can be contacted to access collated data and for further information.

ABSTRACT

Objectives

To determine if increased exposure to clinical specialties at medical school is associated with increased interest in pursuing that specialty as a career after foundation training.

Design

A retrospective observational study.

Setting

31 UK medical schools were asked how much time students spend in each of the clinical specialties. We excluded two schools that were solely Graduate Entry, and two schools were excluded for insufficient information.

Main outcome measures

Time spent on clinical placement from UK undergraduate medical schools, and the training destinations of graduates from each school. A general linear model was used to analyse the relationship between the number of weeks spent in a specialty at medical school and the percentage of graduates from that medical school entering each of the CT1/ST1 specialties directly after FY2.

Results

Students spend a median of 85 weeks in clinical training. This includes a median of 28 weeks on medical firms, 15 weeks in surgical firms, and 8 weeks in general practice (GP). In general, the number of training posts available in a specialty was proportionate to the number of weeks spent in medical school, with some notable exceptions including General Practice.

Importantly, we found that the number of weeks spent in a specialty at medical school did not predict the percentage of graduates of that school training in that specialty at CT1/ST1 level (ß coefficient= 0.061, p=0.228).

Conclusions

This study found that there was no correlation between the percentage of FY2 doctors appointed directly to a CT1/ST1 specialty and the length of time that they would have spent in those specialties at medical school. This suggests that curriculum adjustments focusing solely on length of time spent in a specialty in medical school would be unlikely to solve recruitment gaps in individual specialties.

Strengths and limitations of this study

- This study synthesises a large dataset on the amount of time spent in clinical specialties for students in 27 of the 29 UK undergraduate medical schools, using a novel and reproducible method of data collection (freedom of information requests) to demonstrate a marked heterogeneity amongst UK medical school curricula.
- Rather than relying on subjective metrics such as questionnaires to determine what motivated junior doctor career decisions, we looked at actual successful career training allocations for 2672 doctors, and used an objective metric (the time schools allocate to specialities) to examine the role specialty exposure plays in career decision making for all clinical specialties available at CT1/ST1 level.
- Among the limitations, this study collected data on curricula and of the speciality decisions of doctors entering CT1/ST1 in 2016, although these doctors would have completed medical school in 2014. The 2014 curricula that these doctors were exposed to may have been different from the 2016 curricula that we obtained information on.

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- This study only considered graduates who entered CT1/ST1 directly after FY2, and therefore there is missing data for approximately half of all doctors; the factors influencing these doctors on speciality decisions may differ significantly. We also do not have data on which specialty doctors *applied to* for their CT1/ST1 jobs, only the specialty they obtained a job in.

- The impact of student-selected components or assistantships, and any exposure to specialties during the “pre-clinical” portion of medical teaching, could not be assessed, although the weeks spent in these placements may influence career choice.

INTRODUCTION

The NHS is facing unprecedented recruitment pressures, particularly in areas such as General Practice (GP). In 2015, the Department of Health set a specified target to recruit an extra 5000 GPs by 2020[1]. However, there are concerns this target may not be met [2]. Other areas are also facing pressures, notably psychiatry and emergency medicine [3]. It has been suggested that increasing exposure to these specialties at medical school may help increase recruitment[4–9]. We wished to investigate this hypothesis.

After medical school, doctors in the UK enter a two-year Foundation programme (FY1, FY2), the completion of which allows entry into a specialty training programme after a competitive application process. Approximately half of FY2 doctors progress directly into these training programmes, whilst the other half take time out or do not continue postgraduate training. Further specialty training takes the form of Core Training (CT1) or Specialty Training (ST1) programmes. Core training programmes are generally two years long, and trainees then progress into specialty training programmes (ST3), whereas specialty training programmes run straight through from ST1 to completion of training.

Several factors may influence the specialty that doctors choose to enter, including personality traits, perceptions of the work-life balance, length of training, and quality of placements during medical school[10]. These have generally been studied through questionnaires of medical students or junior doctors. Outside of the UK, studied approaches to increase recruitment to hard-to-recruit specialities or rural areas have included placing students local to home, early sign-ups for medical internships, and mentoring [4–6], with some studies suggesting that positive rural placements lead to increased interest in rural practice [7,8]. Within the UK, it has also been suggested that length of exposure to a medical specialty at medical school influences career choice [9,11–15]. Based on this, it is argued that medical school curricula should be more appropriately tailored to the recruitment demands of the 21st century.

Recent research appears to have identified an association between the quantity of clinical GP teaching at medical school and entry into UK general practice training; Alberti (2017) found that there was a statistically significant association between the quantity of clinical GP training and the percentage of graduates entering the general practice training pathway directly after FY2[9]. However other specialties have not, to our knowledge, been examined in the same way. The majority of other evidence supporting the suggestion that exposure determines later choices comes from surveys conducted during medical school, where students are asked either about their interest in pursuing a specialty after having been exposed to that specialty on placement [11,14,15], or about their perceptions or attitude to that specialty as a whole [16]. However, preferences at this point may be transient [17] and so not actually have an impact on future career decisions. Furthermore, historical trends do not appear to show that progressive increases in exposure to General Practice over the last 30 years [6] have correlated with an increase in the proportion of UK graduates entering general practice [18].

In the UK, the General Medical Council supports and regulates medical education, and is responsible for quality assurance. Medical schools are free to design their own curricula, and guidance prior to 2016 [19] stated that these curricula must be structured to include a range of specialties, *"including medicine, obstetrics and gynaecology, paediatrics, surgery, psychiatry and general practice"*. However, since January 2016, when *Tomorrow's Doctors* [19] was superseded by *Promoting excellence* [20], the guidance on the clinical specialties that students must be exposed to has become more generalised - now simply stating that "*medical school curricula must give medical students experience in a range of specialties, in different settings, with the diversity of patient groups that they would see when working as a doctor (R5.3b).*"

We wanted to understand the current exposure to different medical specialties at UK undergraduate medical schools and examine how this compared with the number of posts available at CT1/ST1. We also wanted to examine the relationship between exposure to clinical specialties at medical school and the percentage of each school's graduates being appointed to each postgraduate CT1/ST1 specialty training programme directly after FY2.

METHODS

Data collection

Freedom of Information (FOI) requests were sent to all 29 UK undergraduate medical schools asking how much time students spend on placement in each of the medical specialties as part of their clinical education. We excluded schools that were solely Graduate Entry due to differences in the structure of their curricula, and we also excluded recently-established schools who had not yet produced medical graduates. Where data were missing, or medical schools did not respond, we accessed university websites (March 2017) to obtain as complete a dataset as possible.

An additional FOI request was sent to Health Education England to determine the medical school attended by each doctor entering a specialty training programme immediately after foundation training in 2016. This used the self-declared appointments of FY2 doctors completing the mandatory National F2 Career Destination Survey 2016. Approximately half of these doctors did not enter any specialty training programme at this point. We received permission from Health Education England to publish the data in a journal.

Finally, we accessed publicly available data on 2016 specialty training posts and applications from the Health Education England website.

Patient and Public Involvement

There was no patient or public involvement in this study.

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Data cleaning

Data were collated into a spreadsheet and analysed with Microsoft Excel 2016, SPSS Version 24.0, and SciPy (Scipy 0.19.1, python 3.6.0).

Any medical schools for which we could only classify a number of weeks less than one interquartile range below the lower quartile (Q1 - IQR) were excluded due to insufficient data. The names and scope of individual curricula components differed between medical schools. We therefore standardised the curricula based on the training programmes offered by Health Education England (HEE) so that appropriate curriculum components were linked with their relevant CT1/ST1 specialty (Appendix Table A1). As very few medical schools offered cardiothoracic surgery, maxillofacial surgery, or neurosurgery specifically, and all three are available at both ST1 and ST3 level, we combined these into Surgery.

Special attention is drawn to the components of the Acute Care Common Stem programme (ACCS): Emergency Medicine, Anaesthetics, Critical Care, Acute Medicine. The latter two of these were combined into Medicine for the first part of the analysis, as this is how Health Education England group the subjects. However, for the final part of our analysis, specialty information from the survey carried out by UKFPO was provided with data grouped as “Acute Care Common Stem (ACCS)” and “Anaesthetics”. We collated both into a single “ACCS” specialty, and compared this with a composite category from our curricula data with all four ACCS components (Figure 1).

Statistical models

A Shapiro Wilk test for normality was performed using SPSS Version 24.0 to determine appropriate descriptive statistics to describe our data. The Shapiro-Wilk test for normality revealed that data for two specialties, ACCS and Ophthalmology, were non-normally distributed, so the median was used to describe all data.

A general linear model was used to analyse the relationship between the number of weeks spent in a specialty at medical school and the percentage of FY2 graduates from that medical school entering each of the CT1/ST1 specialties.

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RESULTS

Current clinical curricula at UK undergraduate medical schools

Our FOI requests gathered responses that detailed placement time for all clinical years from 24 of the 29 established undergraduate medical schools in the UK. Three of the five remaining schools had sufficiently detailed information on their websites for our analysis. The remaining two medical schools were excluded due to insufficient data, leaving 27 medical schools in our analysis.

UK medical students spend a median of 85 weeks in clinical training, with a wide variation between medical schools (range 64-99, Figure 2).

During this time, a median of 28 (IQR 22-35) weeks is spent in medical specialties, 15 (IQR 11-18) weeks in surgical specialties, and eight (IQR 5-10) weeks in general practice (Figure 3). The remaining time is spent on Obstetrics and Gynaecology, Paediatrics, and Psychiatry (six weeks each), Ophthalmology (one week; Figure 3) and other specialties.

Notably, most medical schools had several weeks that could not be classified, as the information provided by the medical school was unclear, or it varied between students, such as in student-selected components (also known as ‘special study modules’) or FY1 shadowing/student assistantships. Medical schools had a median of 5.2 weeks in this “Unknown” category.

From the available data it appeared that some specialties lacked dedicated time within the curricula of most medical schools. Notably, of 27 schools, only 10 reported dedicated time in

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Anaesthetics, only 6 for public health and 3 for clinical radiology. None of the medical schools allocated any clinical time specifically to histopathology that was labelled as such.

Median medical school exposure and number of CT1/ST1 training posts and applications

We first examined the median exposure to a specialty across all medical schools, and compared this with the total nationwide number of training posts available in that specialty at CT1/ST1 level (Figure 4). Excluding General Practice, there is a statistically significant positive relationship between the median length of time spent in a specialty at medical school and the number of training posts available in that specialty at CT1/ST1 level (when excluding GP, correlation = 0.91, p<0.001). General Practice is notable for having a much higher proportion of jobs available (3802 posts, 43% of all CT1/ST1 jobs) compared to the number of weeks spent on clinical attachment at medical school (median eight weeks; less than 10% of time in the clinical years of medical school). To better visualise specialties that were comparatively over- or under-represented at medical school, we have plotted a line of best fit for all hospital specialties (i.e. excluding General Practice).

We found similar results when we considered median medical school exposure and the total number of *applications* to CT1/ST1 posts (Appendix Figure 1).

Medical school exposure and number of alumni entering CT1/ST1 specialty training after FY2

The data obtained from Health Education England included 6752 respondents from 34 UK medical schools and categories for non-UK EEA and non-EEA schools. Of these, 3231 doctors (47.85%) reported that their next destination was Specialty training in the UK. Non-

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287 UK and graduate medical schools were excluded, as were those responses that were left
288 blank. This left 2672 responses. These results were normalised with the total number of
289 respondents as the denominator, to give the percentage of respondents from each included
290 medical school that picked a particular specialty (including GP). This was then compared with
291 the number of weeks that students from that medical school spend on that specialty.
292
293 A generalised linear model was fitted to investigate the relationship between medical school
294 exposure and number of alumni entering speciality training. The dependent variable was the
295 percentage of graduates from each medical school who entered a specialty after FY2, and the
296 independent variables were the number of weeks during medical school spent on that
297 speciality, the speciality, and the medical school. Our model shows the number of weeks of
298 training does not have any impact on the percentage of alumni choosing the speciality (ß
299 coefficient= 0.061, p=0.228).
300
301 A scatter plot (Figure 5) visualises this this relationship. Overall, there is a clear correlation
302 between the number of weeks spent on a specialty and the percentage of doctors picking that
303 specialty after FY2: medical students spend more weeks in specialties that have more jobs.
304 However, looking at any individual specialty, there is no association; i.e. changing the number
305 of weeks spent on a specialty between medical schools has no impact on the percentage of
306 FY2 doctors entering that specialty.
307

DISCUSSION

We found that the clinical curriculum in medical schools across the country varies widely, both in the total number of weeks spent in clinical education, and in how this time was divided among different clinical specialties. This division of time in medical school is generally proportional with the number of posts available at CT1/ST1 level, with the notable exception of General Practice. However, we found no evidence that spending more weeks on a specialty placement at medical school had any effect on a students' likelihood of entering that subject at CT1/ST1 level.

Compared with the percentage of CT1/ST1 jobs available, students spent a disproportionately long time in medical school on Obstetrics & Gynaecology (O&G) and Surgical specialties. Conversely, general practice (GP) was under-represented, with students spending a median of 8 weeks (9%) on GP placements, even though over 40% of CT1/ST1 posts were in general practice. Similarly, students spent less time in the Acute Care Common Stem specialties than the number of CT1 jobs would imply is appropriate, and 17 schools did not report any formal time in Anaesthetics.

We also found that most medical schools did not allocate and label any specific clinical time on Radiology, Histopathology, or Public Health. It may be argued that much of the content of these specialties is covered in pre-clinical and extra-clinical education, and some specialties have greater crossover than others - for example, radiology is interwoven into most other specialties; positive exposure to obstetrics could make a student more sympathetic to surgery in general; end of life experiences across all specialties could encourage an interest in palliative medicine. Similarly, the lower amount of time spent on GP placement may simply

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be because many of the diseases and treatments experienced in GP are also encountered across the various hospital specialties.

However, their exclusion may force many doctors to seek exposure during taster weeks in the Foundation years if they wish to experience the day-to-day life of doctors in these specialties. This is significant as data from UKFPO (2016) show that 62% of doctors do not change their first preference of specialty training programme over the course of their Foundation years [21]. Of those that do, 19.7% preferred a different specialty, rather than being deterred from their original choice due to a negative rotation (3%) or due to a change in personal circumstances (7.8%) [21]. Additionally, some competitive specialties such as neurosurgery usually require a rich CV with multiple publications in order to secure a training number, which may be hampered by insufficient exposure during medical school. Overall, however, our data suggest that relative exclusion or overemphasis of specialties does not appear to affect career decisions. This is contrary to previous studies that used survey responses after medical school placements [11,14–16].

Our results also differ from a study conducted by Alberti et al. using data from doctors starting GP training in 2014 & 2015, which had reported a significant association between the quantity of “authentic” general practice teaching in medical school (defined as teaching in a practice with patient contact) and the percentage of graduates entering GP training [9] directly after F2. We looked at all specialty training programmes, including GP training, and found no association. This difference may be explained by a number of factors. Firstly, a statistically significant association (defined without correction for multiple analyses at p=0.05) was only found in the subgroup analysis for “authentic general practice teaching” whereas our analysis may have also captured non-clinical speciality exposure during clinical years, for example through small group teaching. Secondly, the observed association was weak; Alberti reported correlation coefficients of 0.41 and 0.3 for 2014 and 2015 respectively.

This result does not exclude the possibility that time spent on specialty rotations does affect career preference, rather that whatever that effect may be did not translate to a measurable change in specialty training choice in our study. Any effect may also be masked by other factors. For example, some students may be dissuaded from doing a specialty after placement time, or doing a placement may encourage students to choose a specialty, but in a non-linear way - such that doing 10 weeks may be no more influential than doing one week. As reported in Burford et al. when investigating student interest in the brain-related specialties, factors such as a negative experience on placement were self-reported as deterrents, but additional factors such as positive experiences during intercalated degrees may be influential [22].

We believe our study is the first to consider actual career destinations of all UK CT1/ST1 doctors in a single year group cohort and attempt to correspond these with the clinical curricula of their medical school. We acquired unpublished data directly from nearly all medical schools in the UK from Health Education England, and hope this resource may be helpful for educators and students.

There were several limitations in our methodology. Firstly, we looked at 2016/17 data for the medical school curricula, and 2016 data for CT1/ST1 jobs. However, doctors applying in the 2016 cycle would have completed medical school in 2014. The curricula at their medical school may have changed in that time.

Secondly, we looked at just one year's worth of data, while the number of doctors entering each training programme changes year-on-year. However, this year-on-year variation is small relative to the differences between specialties (Appendix Figure 2).

Furthermore since our data were from UKFPO's report on destinations after F2, we only have information on doctors who are directly progressing to ST1/CT1 immediately after F2. We do not have information on the specialties chosen by the 50.4% of doctors who did not directly enter specialty training after F2. These graduates may disproportionately be those attempting to enter competitive specialties, or doctors who are still undecided between multiple specialties, and therefore the speciality decisions of these doctors remain unknown.

Thirdly, it is possible that some exposure to certain specialities was not captured by our study. Every medical school we studied had some time allocated for student-selected components (special study modules), or assistantships. The specialties involved in these components of clinical courses would vary from student to student, and so we could not categorically allocate it to any individual specialty. A median of 5.2 weeks (IQR 3.6-12) is spent on this "Unknown" category, and for some students this will have included specialties we thought were under- or over-represented. Indeed, student-selected components are frequently chosen in the specialties students most think they wish to do in the future, and therefore this "Unknown" may hide the most formative weeks in a student's clinical education.

In addition, it should be mentioned that some medical schools are moving towards earlier clinical contact even from the first year. This is particularly the case for General Practice where some schools conduct visits once a week during the traditionally 'preclinical' years. Depending on how universities interpreted our request, such exposure could have been missed.

Finally, we do not have a breakdown of which specialty each doctor *applied to* for their CT1/ST1 job based on their medical schools. The application process is competitive, so even if spending longer on a placement increased an applicant's desire to enter a specialty, this may not show itself in the numbers of candidates who were successful. We do note however that on a nationwide scale, the specialties that that are oversubscribed at CT1/ST1 level are not those that are over-represented in medical school [21].

Conclusion

UK medical school curricula are heterogeneous, with different universities allocating often vastly different amounts of time to different specialties. Across the UK as a whole, the amount of time spent in medical school on a specialty is approximately proportional with number of specialty training posts available in that specialty, with notable exceptions including GP. However, analyses from our study have suggested that the amount of time spent in different specialties at medical school does not impact on the likelihood of graduates from that medical school entering that specialty directly after completion of Foundation Training.

Our findings challenge the perception that increasing specialty exposure enhances recruitment and suggest that curriculum adjustments focusing solely on length of time in certain settings will not resolve recruitment gaps going forward.

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FIGURE LEGENDS

Figure 1: Sorting of ACCS Specialities according to individual analyses

Figure 2: Total time in clinical training in UK undergraduate medical schools

Figure 3: Box plots showing median length of time spent at medical school in different clinical specialities, with whiskers showing range. *Medicine includes Acute Medicine & Critical Care.

Figure 4: Scatter plot comparing CT1/ST1 posts available for a specialty and the median number of weeks spent on that speciality at medical school. Line of best fit drawn using all hospital specialties; i.e. excluding General Practice.

Figure 5: Scatter plot comparing number of weeks spent in a specialty at medical school, with the percentage of graduates from that medical school who entered that specialty after F2.

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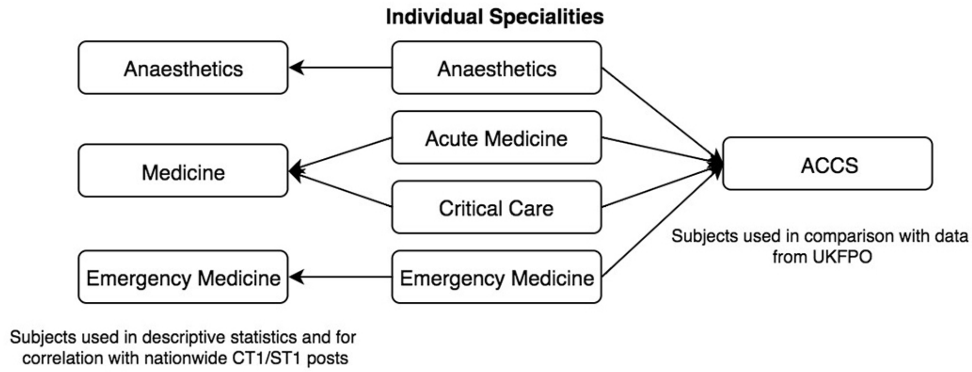

Figure 1: Sorting of ACCS Specialities according to individual analyses

90x34mm (300 x 300 DPI)

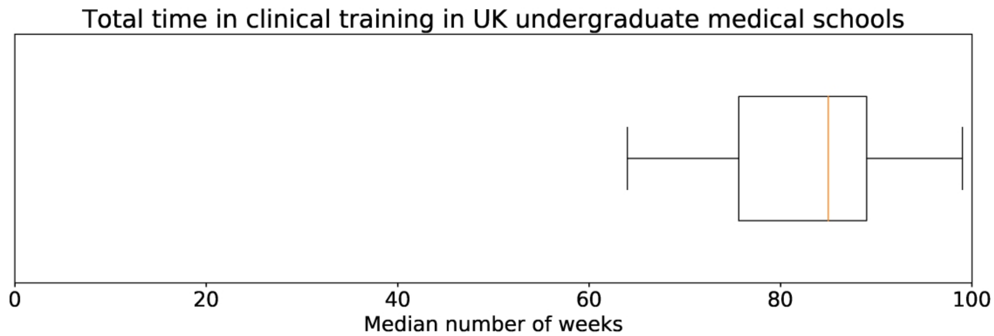

Figure 2: Total time in clinical training in UK undergraduate medical schools

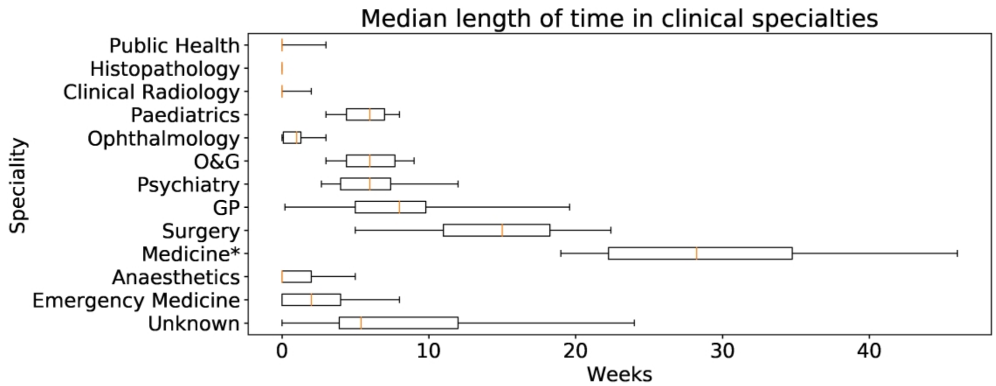

Figure 3: Box plots showing median length of time spent at medical school in different clinical specialities, with whiskers showing range. *Medicine includes Acute Medicine & Critical Care.

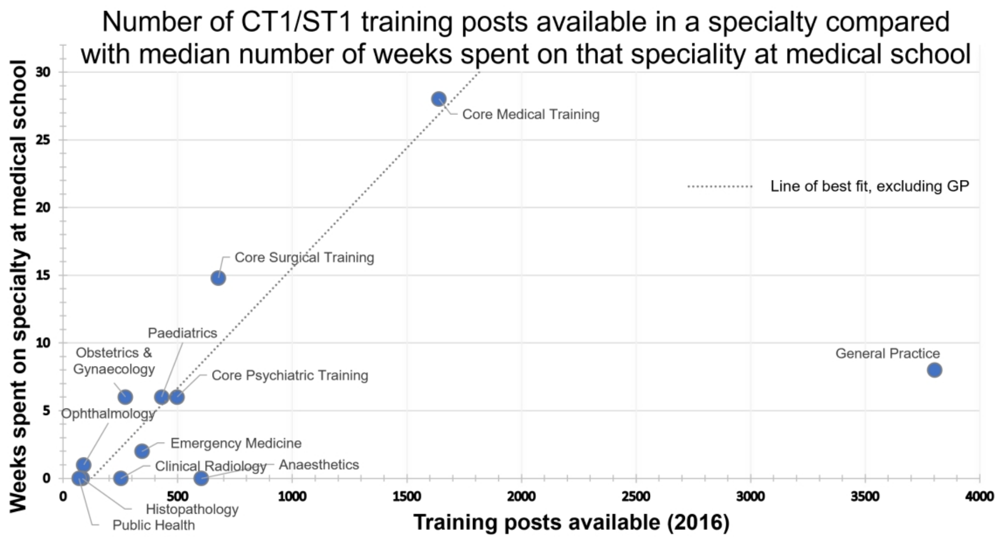

Figure 4: Scatter plot comparing CT1/ST1 posts available for a specialty and the median number of weeks spent on that speciality at medical school. Line of best fit drawn using all hospital specialties; i.e. excluding General Practice.

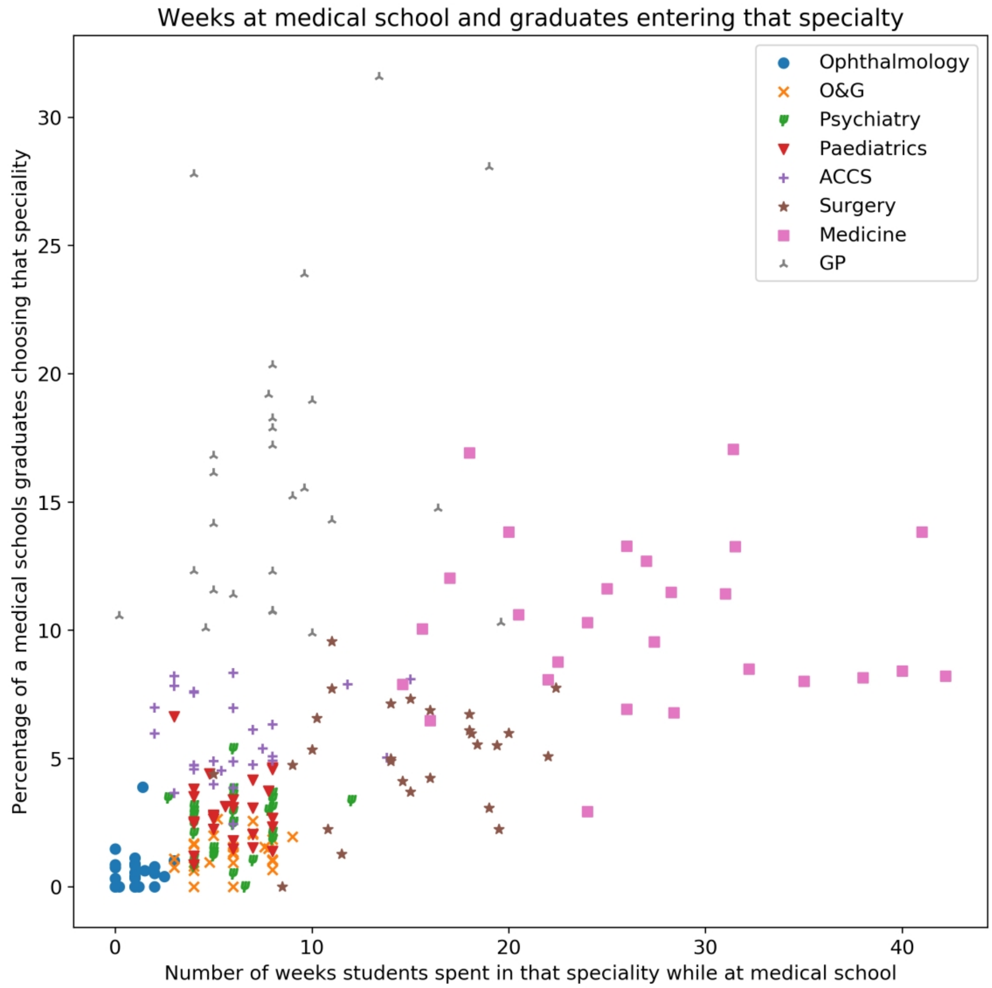

Figure 5: Scatter plot comparing number of weeks spent in a specialty at medical school, with the percentage of graduates from that medical school who entered that specialty after F2.

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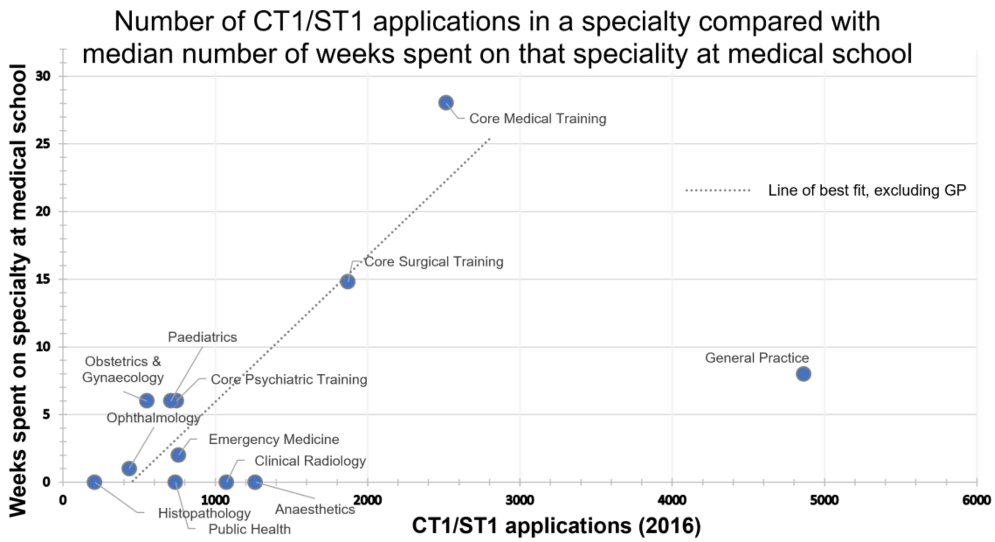
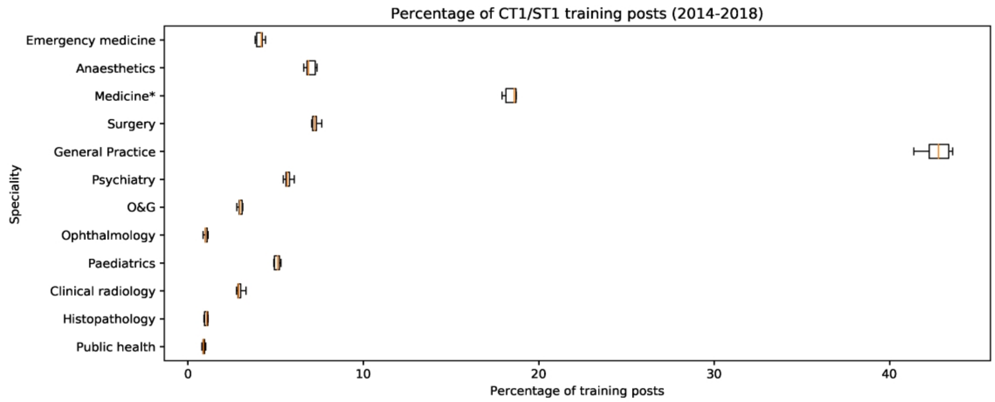


Appendix Figure 1: Scatter plot comparing CT1/ST1 applications for a specialty and the median number of weeks spent on that speciality at medical school. Line of best fit drawn using all hospital specialties; i.e. excluding General Practice.



Appendix Figure 2: Box plot showing the number of training posts for each clinical specialty between 2014 and 2018.

Appendix

FREEDOM OF INFORMATION REQUESTS:

To universities:

Dear [University],

My enquiry relates to your undergraduate Medicine course.

I am seeking information on:

- How much time medical undergraduates spend on "placement" in each of the medical specialties as part of their clinical education.

I would be very grateful if this information could be provided as accurately as is possible - in months, weeks or days depending on the length of time.

I would prefer if this information could be broken down as much as possible - so if, for example, you have a broadly titled 'Neurology, Ophthalmology and Psychiatry' rotation, please provide information broken down by specialty (e.g. Neurology - 1 month, Psychiatry - 1 month, Ophthalmology - 1 week.)

If you are unable to provide me with this information to the level of detail requested, I would appreciate it if you could give me the information with as much detail as is possible.

Thank you very much for your assistance - I really appreciate it.

Yours faithfully,

Ms Alexander

To the UK Foundation Programme Office:

I have read with interest your published careers destination report for 2016, particularly appendices B and D where the destinations are broken down by medical school. Appendix D shows % appointed to specialty training, GP training and Psychiatry training respectively. Do you have that data broken into what specialty training programme the F2s were appointed to i.e Core Medical Training vs Obs and Gynae vs Paeds etc? If you do and it is possible, would you be able to send me that information?

Final year medical student, Alexander Emery

HEE specialty	**Subjects in medical school curricula combined**
Anaesthetics	Anaesthetics*
Clinical Radiology	Clinical Radiology
Core Medical Training	**Acute Medicine*** **Critical Care*** General Medicine, Cardiology, Respiratory, Haematology, Oncology, Palliative care, Rheumatology, Endocrinology, Neurology, Stroke, GUM/Sexual, Care of the Elderly, Dermatology, Infectious Diseases, Hepatology, Gastroenterology, Nephrology
Core Psychiatry training	Psychiatry
Core Surgical Training	**Cardiothoracic surgery** **Oral & Maxillofacial surgery** **Neurosurgery** General surgery, Breast, Gastrointestinal, Vascular, Orthopaedics, Plastics, Urology, Trauma, ENT
Emergency Medicine	Emergency Medicine*
General Practice	General Practice
Histopathology	Histopathology
Paediatrics	Paediatrics
Public Health	Public Health
Obstetrics &	Obstetrics & Gynaecology

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Gynaecology	Women’s Health
Ophthalmology	Ophthalmology

Table A1: shows how individual components of different medical school curricular were combined for purposes of analysis. * = ACCS specialties.

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Figure A1: Scatter plot comparing CT1/ST1 applications for a specialty and the median number of weeks spent on that speciality at medical school. Line of best fit drawn using all hospital specialties; i.e. excluding General Practice.

Figure A2: Box plot showing the number of training posts for each clinical specialty between 2014 and 2018, using public data from Health Education England

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STROBE Statement

		Recommendation	Page Number
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6-7
Objectives	3	State specific objectives, including any prespecified hypotheses	8
Methods			
Study design	4	Present key elements of study design early in the paper	1
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9-11

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Bias	9	Describe any efforts to address potential sources of bias	9-11
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	9-10
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12-14
		(b) Give reasons for non-participation at each stage	12-14
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	N/A
		(b) Indicate number of participants with missing data for each variable of interest	11

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Outcome data	15*	Report numbers of outcome events or summary measures	N/A
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13-14
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17-19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19
Generalisability	21	Discuss the generalisability (external validity) of the study results	18-19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	1

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*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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